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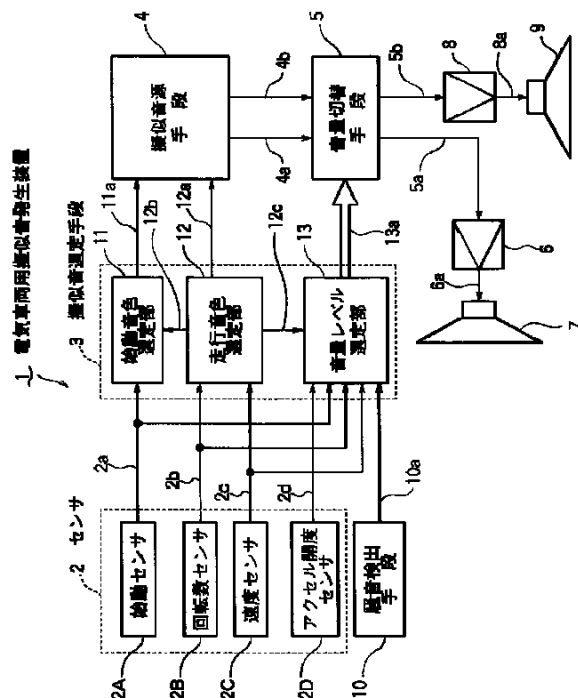
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(54) 【発明の名称】 電気車両用擬似音発生装置

(57) 【要約】

【目的】 電気車両に適した始動音、走行音、および走行中の加速／減速音の擬似音を発生するとともに、周囲騒音に応じて擬似音量を調節することができる電気車両用擬似音発生装置を提供する。

【構成】 始動センサ2A、回転数センサ2B（または速度センサ2C）およびアクセル開度2Dからのセンサ情報に基づいて擬似音選定手段3が、始動、走行および走行中の加速／減速の車両動作状態に対応した擬似音信号を発生する擬似音源手段4の音色を選択するとともに、擬似音信号のレベルを調整する音量切替手段5を制御し、増幅器6、8を介してスピーカ7、9から擬似音を発生する。また、周囲騒音を検出する騒音検出手段10を備え、騒音レベルに対応して音量切替手段5を制御する。



【特許請求の範囲】

【請求項1】 電気車両の始動を検出する始動センサと、モータの回転数を検出する回転数センサと、アクセル開度を検出するアクセル開度センサを備えるとともに、これらのセンサからの始動情報、回転数情報およびアクセル開度情報に基づいて擬似音モードを選定する擬似音選定手段と、この擬似音選定手段の出力に基づいて擬似音を発生する擬似音源手段と、擬似音の音量を切替える音量切替手段とを備え、電気車両の動作状態に対応した擬似音を発生することを特徴とする電気車両用擬似音発生装置。

【請求項2】 周囲騒音を検出する騒音検出手段を備え、この騒音検出手段からの騒音情報に基づいて前記音量切替手段を制御し、周囲騒音に応じて擬似音量を変化することを特徴とする請求項1記載の電気車両用擬似音発生装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は電気車両（EVと称する。）用擬似音発生装置に係り、特に始動、走行、走行時の加速／減速の動作状態、および周囲騒音に対応した擬似音を発生する電気車両用擬似音発生装置に関する。

【0002】

【従来の技術】従来の電気車両用擬似音発生装置は、実開昭56-166701号公報や実開昭56-171501号公報に開示されているように、電気車両が前進、または後進する場合に、前進と後進の警報音を変えたり、前進と後進の車速に対応して警報音を変えるように構成したものは知られている。

【0003】これらの電気車両用擬似音発生装置は、警報音の発振源にマルチバイブレータを用いてパルス信号を生成し、パルスの周波数やデューティ（パルス幅）を変化して異なる音色を発生するよう構成されている。

【0004】

【発明が解決しようとする課題】従来の電気車両用擬似音発生装置は、パルス信号の周波数、またはデューティを変化することで音色を変えているため、発生する音は単純な音であり警報音には適するが、自動車の動作状態をドライバや通行人に知らせる手段としては、実際のガソリン自動車が発生するエンジン音等からは余りにもか

【0005】また、ガソリン自動車は停車中でもアイドル状態にするとエンジン音を発生するが、電気車両は停車中にモータを停止するので無音となるため、ガソリン自動車と電気車両は音発生に差異がある。

【0006】この発明はこのような課題を解決するためになされたもので、電気車両が停車中でも始動の擬似音を発生するとともに、走行および走行中の加速／減速状態に適した擬似音を発生し、歩行者やドライバに車両状態を知らすことができる電気車両用擬似音発生装置を提

供することを目的とする。

【0007】

【課題を解決するための手段】前記課題を解決するためこの発明に係る電気車両用擬似音発生装置は、電気車両の始動を検出する始動センサと、モータの回転数を検出する回転数センサと、アクセル開度を検出するアクセル開度センサを備えるとともに、これらのセンサからの始動情報、回転数情報およびアクセル開度情報に基づいて擬似音モードを選定する擬似音選定手段と、この擬似音選定手段の出力に基づいて擬似音を発生する擬似音源手段と、擬似音の音量を切替える音量切替手段とを備え、電気車両の動作状態に対応した擬似音を発生することを特徴とする。

【0008】また、この発明に係る電気車両用擬似音発生装置は、周囲騒音を検出する騒音検出手段を備え、この騒音検出手段からの騒音情報に基づいて音量切替手段を制御し、周囲騒音に応じて擬似音量を変化することを特徴とする。

【0009】

【作用】この発明に係る電気車両用擬似音発生装置は、始動情報、回転数情報およびアクセル開度情報に基づいて電気車両の状態に対応した擬似動作音を発生することができる。

【0010】また、この発明に係る電気車両用擬似音発生装置は、周囲騒音に対応して電気車両の擬似動作音の音量を増減することができる。

【0011】

【実施例】以下、この発明の実施例を添付図面に基づいて説明する。図1はこの発明に係る電気車両用擬似音発生装置の全体ブロック構成図である。図1において、電気車両用擬似音発生装置1は、センサ2と、擬似音選択手段3と、擬似音源手段4と、音量切替手段5と、増幅器6、8と、スピーカ7、9と、騒音検出手段10とから構成する。なお、擬似音選択手段3、擬似音源手段4および音量切替手段5は、図示しないマイクロプロセッサで制御され、それぞれの構成の一部、または全てをマイクロプロセッサで構成する。

【0012】センサ2は、始動センサ2A、回転数センサ2B、速度センサ2C、アクセル開度センサ2Dを備える。始動センサ2Aは、ドライバがスタータスイッチ、イグニッションスイッチ、シフトポジションスイッチ（いずれも図示しない）等の車両キーを操作して始動したことを検知し、始動（S）信号2aを発生し、この始動信号2aを擬似音選択手段3に送る。また、始動センサ2Aは、図示しないが例えば、車両キーを操作した場合の電気車両用擬似音発生装置1に印加される電源を検出して検出信号を発生する電圧検出器、または車両キー操作（例えば回転）により駆動されるスイッチ等を用いて構成することができる。

【0013】電気車両の始動には、車両放置状態から走

行可能状態にするため、スタータスイッチをオン、イグニッションスイッチをオンにし、シフトポジションスイッチ位置をPまたはN状態の始動と、走行中の停車状態から発進するため、イグニッションスイッチオン、シフトポジションスイッチ位置をDまたはRの始動や、サイドブレーキスイッチからの始動およびアクセルスイッチからの始動との2種類の始動を想定し、始動センサ2 Aはこれら2種類の始動を区別して検出し、それぞれの始動に対応した始動(S)信号2 aを擬似音選択手段3に送る。なお、始動(S)信号2 aは所定の電圧値、または電流値を出力するように構成する。

【0014】回転数センサ2 Bは、車輪駆動用モータの回転数(N)を検出し、回転数(N)信号2 bを擬似音選択手段3に送る。回転数(N)信号2 bは電圧または電流信号となるよう構成し、例えば車両の前進をプラス(+)レベル、後進をマイナス(-)レベル、または所定のレベルを基準としてレベル増加を前進、レベル減少を後進とし、各々回転数Nに対応した電圧、または電流のレベル値を検出するよう回転数センサ2 Bを構成する。また、回転数センサ2 Bの代りに回転数(N)と相關のある車速(V)を検出するよう速度センサ2 Cを備えることもできる。速度センサ2 Cは車両の車速(V)を検出し、車速(V)信号2 cを擬似音選択手段3に送る。なお、以後の説明は回転数センサ2 Bを用いた場合について述べるが、速度センサCについても同様である。

【0015】アクセル開度センサ2 Dは、アクセルの開度(X)を検出し、アクセル開度(X)信号2 dを擬似音選択手段3に送る。アクセル開度(X)信号2 dもアクセル開度Xに対応した電圧、または電流値を出力するよう構成する。

【0016】このように、センサ2は、電気車両の始動S、モータの回転数N(または車両の車速V)およびアクセル開度Xを検出し、それぞれの検出量に対応した電氣的信号(電圧値、電流値)を出力する。

【0017】擬似音選択手段3は、始動音色選定部1 1、走行音色選定部1 2、音量レベル選定部1 3を備え、センサ2から出力される各種信号に基づいて、擬似音源手段4で発生する電気車両の始動音、走行音の選定を制御するとともに、始動音および走行音の音量の切替をする音量切替手段5の選定を制御するよう構成する。

【0018】始動音色選定部1 1は、始動センサ2 Aからの始動(S)信号2 aに基づいて2種類の始動音色選定情報1 1 aを擬似音源手段4に提供し、予め始動音として設定した音色を選定する。始動音色選定情報1 1 aは、擬似音源手段4の構成、例えば単純な発振周波数の発信器、音声合成手段、またはディジタル・シグナル・プロセッサ(DSP)等を用いた擬似音源に応じて情報を設定し、電圧または電流のオン/オフ情報、ディジタルのビット情報等を発生するよう始動音色選定部1 1を

構成する。また、始動音色選定部1 1は、走行音色選定部1 2の一部分として構成することもできる。

【0019】走行音色選定部1 2は、回転数センサ2 Bからの回転数(N)信号2 bに基づいて、回転数(N)信号2 bの電圧、または電流のレベル値に対応した走行音色選定情報1 2 aを擬似音源手段4に提供する。走行音色選定情報1 2 aも始動音色選定部1 1から出力される始動音色選定情報1 1 aと同様に、例えば単純な発振周波数の発信器、音声合成手段、またはディジタル・シグナル・プロセッサ(DSP)等で構成される擬似音源手段4の形態に対応した、電圧、電流、またはディジタルのビット情報等を発生するよう走行音色選定部1 2を構成する。

【0020】また、走行音色選定部1 2は、音色選定停止信号1 2 bを始動音色選定部1 1に送り、または音量レベル選定停止信号1 2 cを音量レベル選定部1 3に送り、電気車両が走行を開始した場合には始動音を停止するよう制御する。

【0021】音量レベル選定部1 3は、センサ2からの始動(S)信号2 a、回転数(N)信号2 b、アクセル開度(X)信号2 c、または騒音検出手段1 0からの騒音検出情報1 0 aに基づいて、音量切替情報1 3 aを音量切替手段5に提供し、電気車両の始動、モータ回転数(車速)、アクセル開度(加速/減速)に対応した擬似音の音量切替を制御するとともに、周囲騒音に対応した擬似音の音量切替を制御するよう構成する。

【0022】擬似音源手段4は、電気車両の始動、走行(前進または後進)、加速/減速状態に対応した擬似音を発生するための音源であり、例えば単純な発振器、またはその複数の組合せ、さらに変化を出すために変調器を組合せたり、ガソリン自動車の始動、走行、加速/減速の状態音を録音し、合成、出力するよう構成した音声合成ICの採用、または演算/処理して任意の波形を発生することができるディジタル・シグナル・プロセッサ(DSP)等により構成することができる。擬似音源手段4は、始動音色選定部1 1からの始動音色選定情報1 1 aまたは走行音色選定部1 2からの走行音色選定情報1 2 aに基づいて、始動音信号または走行音信号4 a、4 bを音量切替手段5に提供する。

【0023】図2はこの発明に係る電気車両用擬似音発生装置の擬似音源手段の一実施例を示すブロック構成図である。(a)図において、擬似音源手段2 0は、発振器2 1～発振器2 3、加算器2 4、乗算器(変調器)2 5を備え、発振器2 1～発振器2 3にはそれぞれ発振周波数切替用の抵抗群2 1 A～2 3 Aを備える。

【0024】電気車両が始動され、擬似音選定手段3の始動音色選定部1 1から始動音色選定情報1 1 aが提供されると、発振器2 1～発振器2 3は始動音色選定情報1 1 aに基づいて、それぞれ発振周波数切替用の抵抗群2 1 A～2 3 AのRA～RCの中から所定の抵抗値が選

定されて発振周波数 f_{o1} 、 f_{o2} 、 f_{o3} で発振し、発振出力信号21a~23aを出力する。

【0025】発振器21の発振出力信号21aと発振器22の発振出力信号22aは、加算器24で加算され、2周波の加算信号24aを乗算器25に供給する。一方、乗算器25には発振器23からの発振出力信号23aが供給されるため、加算信号24aを発振出力信号23aで変調し、この変調信号を始動音信号4a、または4bとして音量切替手段5に出力する。

【0026】(b)図は、(a)図に対応した信号波形を示す。発振器21~発振器23は正弦波形を出力するように構成したが、矩形波を出力するように構成したり、加算器24の加算出力24aの波形を歪ませることにより基本波と高調波成分を発生するように構成することもできる。また、(b)図では変調をAM(振幅変調)で構成したが、FM(周波数変調)またはPM(位相変調)で構成することにより、異なった音色を得ることもできる。

【0027】なお、始動音信号4a、4bは電気車両内と車両外の音色を異なるようにする場合に図2の構成を2組備えて対応するが、両者の音色が共通な場合には始動音信号4aあるいは4bのいずれか一方でよい。

【0028】次に、電気車両が走行状態になると、走行音色選定部12からの走行音色選定情報12aに基づいて発振器21~発振器23はそれぞれ発振周波数切替用の抵抗群21A~23AのR_A~R_Cの中から所定の抵抗値が選定され、走行音色選定情報12aのレベルに対応した発振周波数 f_1 ~ f_a 、 f_2 ~ f_b 、 f_3 ~ f_c で発振し、発振出力信号21a~23aを出力する。また、発振周波数 f_1 ~ f_a 、 f_2 ~ f_b 、 f_3 ~ f_c は、電気車両の走行速度(モータ回転数に対応)が速くなるに従い、高くなるように設定する。なお、発振波形、加算ならびに乗算(変調)については、図2と同様となる。

【0029】図3はこの発明に係る電気車両用擬似音発生装置の擬似音源手段の別実施例を示すブロック構成図である。図3において、擬似音源手段30は、制御部32、音声合成部33、音声データ部34を備える。

【0030】音声データ部34は、マスクROM等のメモリで構成され、例えばガソリン自動車の始動音(エンジン音)、走行速度または加速/減速に対応した走行音等を予め録音しておき、録音した音に分析等の処理を施した後、音データとして記憶する。

【0031】制御部32は始動音色選定部11からの始動音色選定情報11aまたは走行音色選定部12からの走行音色選定情報12aに基づいて、駆動信号32aを音声合成部33に供給し、音声合成部33は駆動信号32aに基づいて音声データ部34と間で情報34aの受け渡しを行い、音声データ部34に記憶されている音声データを合成して始動音信号、および走行音信号を発生

する。

【0032】合成した始動音信号、および走行音信号は、ガソリン自動車の始動音、走行音を基に生成するため、実際のガソリン自動車に近い音を得ることができる。また、擬似音源手段30を構成する制御部32、音声合成部33および音声データ部34は、それぞれICで構成したり、各ICを集めて混成IC(HIC)で構成したり、音声データが少ない場合は1チップのマイクロプロセッサ(CPU)で構成することができる。

10 【0033】また、擬似音源手段4は、任意の信号波形を発生することができるディジタル・シグナル・プロセッサ(DSP)で構成し、ガソリン自動車の始動音および走行音を再現したり、もしくは電気車両に適した始動音および走行音の擬似音を発生するように構成することもできる。

20 【0034】音量切替手段5は、擬似音源手段4から発生した始動音信号または走行音信号4a、4bを音量レベル選択部13からの音量切替情報13aに基づいて所定の信号レベルに制御し、擬似音信号5a、5bをそれぞれ低周波出力増幅器6、8に送出する。

【0035】図4はこの発明に係る電気車両用擬似音発生装置の音量切替手段の一実施例を示すブロック構成図である。(a)図は抵抗アッテネータ、(b)図は差動増幅器を用いて、おのこの音量切替手段を構成した例を示す。

30 【0036】(a)図の音量切替手段40は、抵抗 r_1 ~ r_n からなるアッテネータ41、抵抗を切替える s_1 ~ s_n からなる切替スイッチ42を備える。切替スイッチ42は、音量レベル選択部13からの音量切替情報13aに対応して s_1 ~ s_n の所定のスイッチを選択し、選択したスイッチに対応してアッテネータ41の減衰量が決定され、擬似音源手段4から発生した始動音信号または走行音信号4a、4bを減衰して擬似音信号5a、5bをそれぞれ低周波出力増幅器6、8に送出する。なお、切替スイッチ42は電子スイッチで構成し、音量切替情報13aである電圧/電流レベルに対応して s_1 ~ s_n を選択したり、または音量切替情報13aであるディジタルのバイナリ値に対応して s_1 ~ s_n を選択するよう構成する。

40 【0037】(b)図の音量切替手段50は、R₁~R_nからなる抵抗群51、 s_1 ~ s_n からなる切替スイッチ52、差動増幅器53を備える。音量切替手段50の減衰量(または増幅量)は、差動増幅器53の入カインピーダンスを抵抗群51で構成することにより、帰還抵抗R_fと抵抗群51との比(R_f/R_1 ~ R_n)で決定することができる。例えば、抵抗群51のR₁が選択された場合、擬似音信号5a、5bのレベルは始動音信号または走行音信号4a、4bのレベルの(R_f/R_1)倍に減衰(または増幅)される。なお、切替スイッチ52は、(a)図の切替スイッチ42と同様に構成する。

【0038】低周波増幅器6および8は、それぞれ音量切替手段5から提供される擬似音信号5a、5bを増幅し、増幅した車両外擬似音信号6a、車両内擬似音信号6bをそれぞれ車両外用スピーカ7、車両内用スピーカ9に入力して電気車両用擬似音を発生させる。

【0039】図5はこの発明に係る電気車両用擬似音発生装置の擬似音の周波数、音量の特性図である。(a)図は電気車両のモータ回転数Nに対する擬似音周波数fの特性、(b)図は電気車両のモータ回転数Nおよびアクセル開度Xに対する擬似音量Pの関係、(c)図は車速Vに対する擬似音量Pの関係を示す。(a)図において、回転数がゼロ(N=0)の場合、つまり電気車両のモータが回転しておらず、ドライバが車両キーを操作した始動状態では始動音の擬似音周波数fはf₀(f=f₀)であることを示す。

【0040】次に、電気車両が走行を開始し、モータの回転数Nが増加するに伴って走行音の擬似音周波数fは回転数Nに比例して高くなり、回転数Nが所定の値N_kを超えると擬似音周波数fはf_k(f=f_k)を保つよう構成する。

【0041】(b)図において、電気車両が始動状態で回転数Nがゼロ(N=0)の場合、始動音の擬似音量PはP₀(dB SPL: sound pressure level)であり、走行状態になると回転数Nの増加に比例して大きくなり、回転数Nが所定の値N_aをこえると走行音の擬似音量Pは飽和して音量P_aを保つよう構成する。また、アクセル開度Xに対する擬似音量Pについては、アクセル開度Xに比例して擬似音量Pを増加し、擬似音量Pは飽和させないよう構成する。

【0042】(c)図は、ガソリン車両と電気車両の車速Vに対する音量を示し、ガソリン車両は車速Vに対応して音量P_gから緩やかに増加するのに対し、電気車両は、例えば車速Vに対応して擬似音量P₀から次第に増加させてガソリン車両の音量との差を埋めていくよう設定する。

【0043】以上のように、図5では擬似音周波数fおよび擬似音量Pを回転数Nやアクセル開度X、および車速Vに比例して直線的に増加するように構成したが、別な曲線関係になるように設定して、適切な電気車両の走行音が得られるよう構成することもできる。

【0044】図6はこの発明に係る電気車両用擬似音発生装置の擬似音の音量特性図である。図6において、電気車両のモータ回転数Nとアクセル開度Xに対する走行音の擬似音圧Pを3次元で示す。

【0045】回転数Nおよび開度Xがゼロの場合(始動時)、擬似音圧はP₀で電気車両は始動状態にあり、走行状態には回転数Nとアクセル開度Xの組合せにより走行中の加速/減速の変化に富んだ擬似音を再現することができる。

【0046】騒音検出手段10は、図示しない周囲騒音

検出用のマイク、マイクで検出したレベル範囲の広い(例えば60ホーン~100ホーン)騒音を所定の範囲に増幅する対数増幅器(logアンプ)、対数増幅器の出力を電流や電圧の直流レベル、またはデジタルのビット符号に変換する変換器等で構成し、騒音レベルを直流レベルやビット符号に変換した騒音検出情報10aを音量レベル選定部13に提供する。

【0047】騒音検出情報10aは、騒音レベルに対応して増減するため、音量レベル選定部13、音量切替手段5を介して車両外用スピーカ7、車両内用スピーカ9から周囲騒音に対応した音量で、始動音、走行音の擬似音を発生する。また、周囲騒音による擬似音量の制御は、始動音またはアクセル操作による加速/減速を含めた走行擬似音量の制御と独立して行うよう構成し、始動音またはアクセル操作による加速/減速を含めた走行擬似音量を大または小方向にシフトするように構成する。

【0048】周囲騒音による電気車両の擬似音の音量特性は、図6に示す始動音またはアクセル操作による加速/減速を含めた走行擬似音量が上下(音量大小)の矢印方向にシフトし、騒音が大きい場合は上(音量増加)方向、騒音が小さい場合は下(音量減少)方向にシフトする。

【0049】なお、電気車両への車両外用スピーカ7、車両内用スピーカ9および騒音検出用マイクの配置は、例えば車両外用スピーカ7を車体の底部、または2個準備して車体の前後に配置して車体の周囲にほぼ均等な音量が得られるよう設置し、騒音検出用マイクは車両外用スピーカ7から発生される擬似音の影響が極力少なくなるよう、車両外用スピーカ7から離れた位置に設置する。車両内用スピーカ9はドライバが煩わしさを感ぜなく、聞き取れる位置を考慮して設置する。

【0050】図7はこの発明に係る電気車両用擬似音発生装置の別実施例全体ブロック構成図である。図7において、電気車両用擬似音発生装置60は、複数の音源(1~n)からなる擬似音源手段61と、この擬似音源手段61の音源1~音源nをドライバが手動操作で切替える音源切替スイッチ63と、手動切替え用の音量切替器を含む音量切替手段62と、この音量切替手段62をドライバが手動操作で切替える音量切替スイッチ64を備えた点が図1と異なる。

【0051】擬似音源手段61は、図1で説明したと同様な構成で異なる擬似音を発生する音源1~音源nを備え、ドライバが手動で音源切替スイッチ63を操作した場合、スイッチ情報63aに対応した音源(1~n)を選択して擬似音を発生し、始動音信号または走行音信号61a、61bを音量切替手段62に提供する。また、擬似音源手段61の音源1~音源nのそれぞれの音源は、図1の擬似音源4と同様に、擬似音選定手段3の始動音色選定部11からの始動音色選定情報11a、または走行音色選定部12からの走行音色選定情報12aに

基づいて制御される。

【0052】音量切替手段62は、図4の(a)、

(b)に示す音量切替用のアッテネータ41または抵抗群51に、例えば直列や並列、または直並列に抵抗群を接続し、ドライバが手動で音量切替スイッチ64を操作した場合、スイッチ信号64aに対応した抵抗群を選定して音量を調節し、擬似音信号62a、62bをそれぞれ低周波出力増幅器6、8に送出する。

【0053】このように、手動切替の擬似音源手段61および音量切替手段62を設けたので、電気車両用擬似音発生装置60はドライバが音源切替スイッチ63、音量切替スイッチ64を手動操作し、好みに応じた音質、音量の擬似音を発生することができる。

【0054】

【発明の効果】以上説明したようにこの発明に係る電気車両用擬似音発生装置は、電気車両の始動、走行、および走行中の加速/減速等の電気車両の状態に適した擬似音を発生することができる。

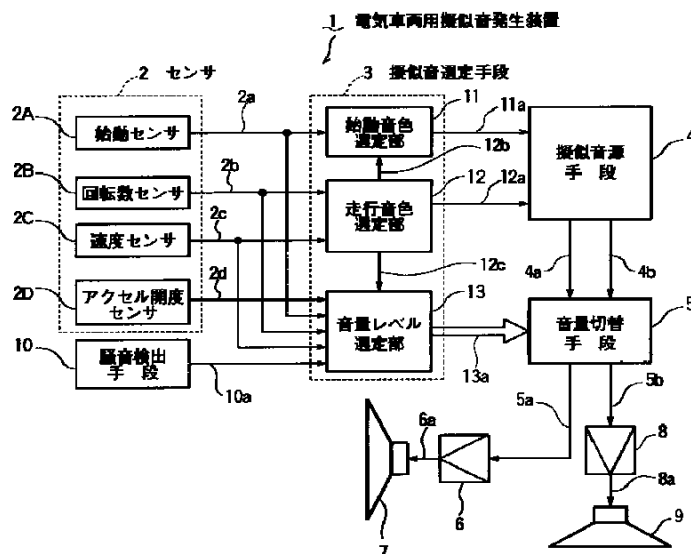
【0055】また、周囲騒音に応じて電気車両の始動、走行、および走行中の加速/減速等の擬似音量を变化することができる。

【0056】よって、歩行者やドライバは、電気車両の始動、および加速/減速の走行状態を認識ことができ、ガソリン自動車に対すると同様な対応をすることができる。

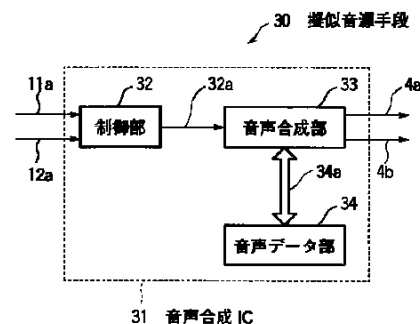
【0057】また、周囲騒音に対応して擬似音を自動的に調節できるので、夜間や静かな場所での低騒音化を実現することができる。

【図面の簡単な説明】

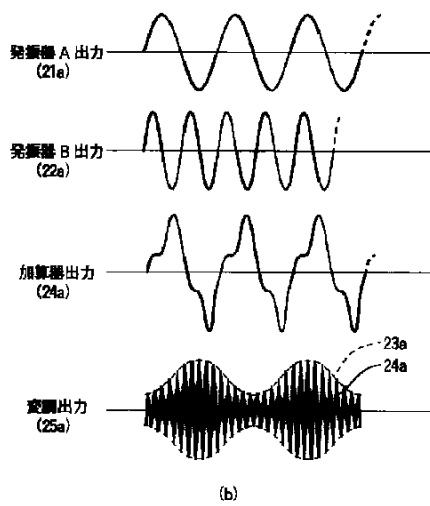
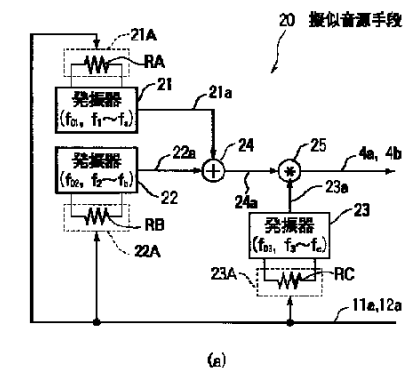
【図1】



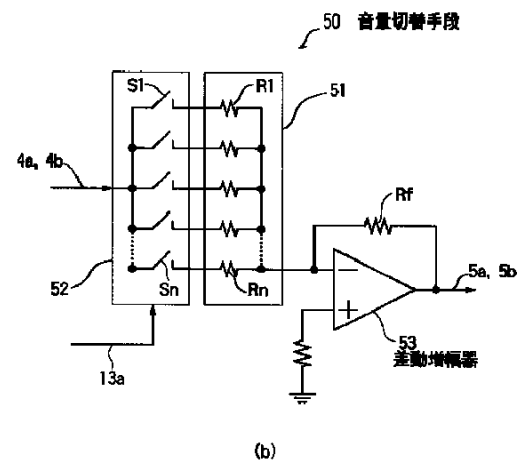
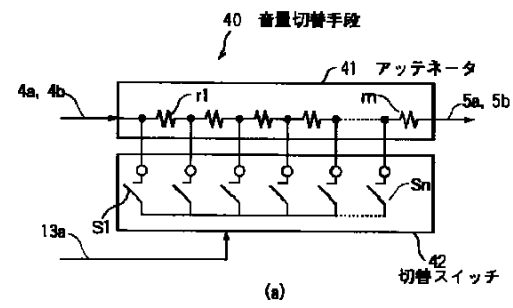
【図3】



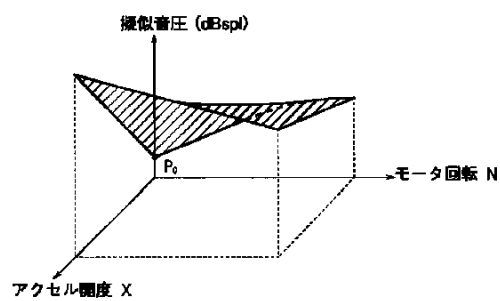
【図2】



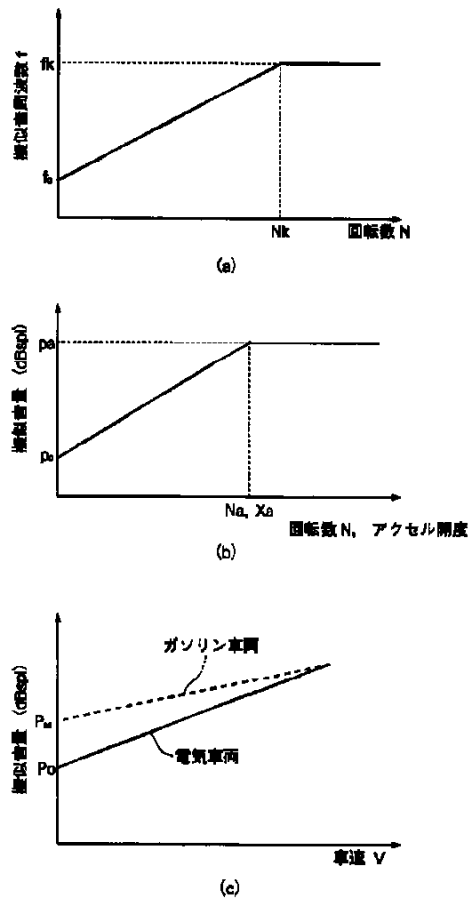
【図4】



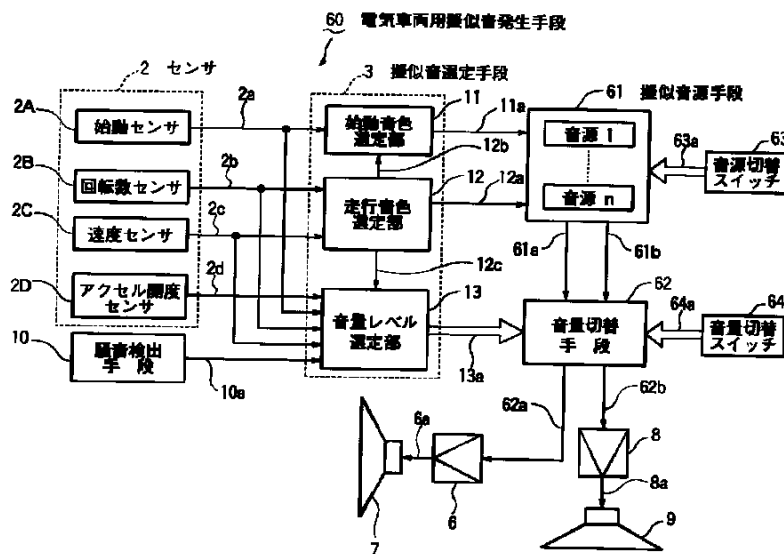
【図6】



【図5】



【図7】



PATENT ABSTRACTS OF JAPAN

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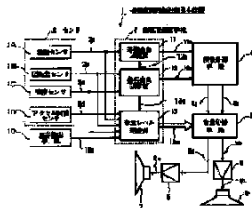
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(54) DEVICE FOR GENERATING PSEUDO SOUND FOR ELECTRIC VEHICLE



(57)Abstract:

PURPOSE: To provide a pseudo sound generating device for an electric vehicle, whereby the pseudo sound implying starting sound, running sound and accelerating/decelerating sound while running which are suitable for the electric

vehicle is generated and also pseudo sound quantity is adjusted in accordance with peripheral noise.

CONSTITUTION: A pseudo sound selecting means 3 selects the sound of a pseudo sound source means 4 which generates a pseudo sound signal corresponding to the vehicle operation state of starting, running and accelerating/decelerating while running based on sensor information from a starting sensor 2A, a rotation number sensor 2B (or a speed sensor 2C) and an accelerator opening degree sensor 2D, a sound quantity changing-over means 5 for adjusting a pseudo sound signal level is controlled and pseudo sound is generated from speakers 7 and 9 with amplifiers 6 and 8. A noise detecting means 10 for detecting peripheral noise is provided so as to control a sound quantity change-over means 5 in accordance with the noise level.

LEGAL STATUS

[Date of request for examination]

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decision of rejection]

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other than the examiner's decision of
rejection or application converted
registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

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examiner's decision of rejection]

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CLAIMS

[Claim(s)]

[Claim 1] While having the starting sensor which detects starting of electric rolling stock, the rotational frequency sensor which detects the rotational frequency of a motor, and the accelerator opening sensor which detects accelerator opening A false sound selection means to select false sound mode based on the starting information, rotational frequency information, and accelerator opening information from these sensors, The false sound generator for electric rolling stock characterized by having a false sound-source means to generate a false sound based on the output of this false sound selection means, and the sound-volume change means which changes the sound volume of a false sound, and generating the false sound corresponding to the operating state of electric rolling stock.

[Claim 2] The false sound generator for electric rolling stock according to claim 1 characterized by having a noise detection means to detect ambient noise, controlling said sound-volume change means based on the noise information from this noise detection means, and changing false sound volume according to ambient noise.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the false sound generator for electric rolling stock which is applied to the false sound generator for electric rolling stock (EV is called.), especially generates the operating state of the acceleration/moderation at the time of starting, transit, and transit, and the false sound corresponding to ambient noise.

[0002]

[Description of the Prior Art] When electric rolling stock move forward or go astern as the conventional false sound generator for electric rolling stock is indicated by the real **** No. 166701 [56 to] official report, and the real **** No. 171501 [56 to] official report, the alarm tone of advance and go-astern is changed, or what was constituted so that an alarm tone might be changed corresponding to the vehicle speed of advance and go-astern is known.

[0003] These false sound generators for electric rolling stock use a multivibrator for the source of an oscillation of an alarm tone, generate a pulse signal, and they are constituted so that a tone which changes and is different in the frequency and duty (pulse width) of a pulse may be generated.

[0004]

[Problem(s) to be Solved by the Invention] Although the sound generated since the tone is changed because the conventional false sound generator for electric rolling stock changes the frequency of a pulse signal or duty is a simple sound and is suitable for an alarm tone, as a means to tell a driver and a passerby about the operating state of an automobile, it is widely different also in remainder and produces a feeling of the different sum from the engine sound which an actual gasoline automobile generates.

[0005] Moreover, if a gasoline automobile is made into an idle state also in a stop, it will generate an engine sound, but since electric rolling stock suspend a motor during a stop and they become silent, a gasoline automobile and electric rolling stock have a difference in sound generating.

[0006] While it was made in order that this invention might solve such a technical problem, and electric rolling stock generate the false sound of starting also in a stop, the false sound suitable for acceleration/moderation condition under transit and transit is generated, and it aims at offering the false sound generator for electric rolling stock which can tell a car condition to a pedestrian and a driver.

[0007]

[Means for Solving the Problem] The false sound generator for electric rolling stock applied to this invention in order to solve said technical problem While having the starting sensor which detects starting of electric rolling stock, the rotational frequency sensor which detects the rotational frequency of a motor, and the accelerator opening sensor which detects accelerator opening A false sound selection means to select false sound mode based on the starting information, rotational frequency information, and accelerator opening information from these sensors, It has a false sound-source means to generate a false sound based on the output of this false sound selection means, and the sound-volume change means which changes the sound volume of a false sound, and is characterized by generating the false sound corresponding to the operating state of electric rolling stock.

[0008] Moreover, the false sound generator for electric rolling stock concerning this invention is equipped with a noise detection means to detect ambient noise, controls a sound-volume change means based on the noise information from this noise detection means, and is characterized by changing false sound volume according to ambient noise.

[0009]

[Function] The false sound generator for electric rolling stock concerning this invention can generate the false actuation sound corresponding to the condition of electric rolling stock based on starting information, rotational frequency information, and accelerator opening information.

[0010] Moreover, the false sound generator for electric rolling stock concerning this invention can fluctuate the sound volume of the false actuation sound of electric rolling stock corresponding to ambient noise.

[0011]

[Example] Hereafter, the example of this invention is explained based on an accompanying drawing. Drawing 1 is the whole false sound generator block diagram for electric rolling stock concerning this invention. In drawing 1, the false sound generator 1 for electric rolling stock consists of a sensor 2, the false sound selection means 3, the false sound-source means 4, the sound-volume change means 5, amplifier 6 and 8, loudspeakers 7 and 9, and a noise detection means 10. In addition, the false sound selection means 3, the false sound-source means 4, and the sound-volume change means 5 are controlled by the microprocessor which is not illustrated, and constitute each all [a part or] from a microprocessor. [all]

[0012] A sensor 2 is equipped with starting sensor 2A, rotational frequency sensor 2B, rate sensor 2C, and accelerator opening sensor 2D. Starting sensor 2A detects that the driver operated car keys, such as a starting switch, an ignition switch, and a shift position switch (neither is illustrated), and started, generates (Starting S) signal 2a, and sends this trigger signal 2a to the false sound selection means 3. Moreover, starting sensor 2A can be constituted using the

electrical-potential-difference detector which detects the power source impressed to the false sound generator 1 for electric rolling stock at the time of operating a car key, and generates a detecting signal, or the switch driven by the car key stroke (for example, rotation), although not illustrated.

[0013] In order to change into the condition which can be run from a car neglect condition at starting of electric rolling stock, a starting switch is turned on and an ignition switch is turned ON. A shift position switch location Starting of P or N condition, In order to depart from the stop condition under transit, ignition switch-on, Starting of D or R and two kinds of starting with starting from starting and the accelerator switch from a handbrake switch are assumed for a shift position switch location. Starting sensor 2A distinguishes and detects these two kinds of starting, and sends (Starting S) signal 2a corresponding to each starting to the false sound selection means 3. In addition, (Starting S) signal 2a is constituted so that a predetermined electrical-potential-difference value or a current value may be outputted.

[0014] Rotational frequency sensor 2B detects the rotational frequency (N) of the motor for a wheel drive, and sends (rotational frequency N) signal 2b to the false sound selection means 3. (Rotational frequency N) signal 2b is constituted so that it may become an electrical potential difference or a current signal, for example, by considering advance of a car as plus (+) level, on the basis of minus (-) level or predetermined level, the increment in level is considered as advance and it considers level reduction for go-astern as go-astern, and it constitutes rotational frequency sensor 2B so that the electrical potential difference corresponding to a rotational frequency N or the level value of a current may be detected respectively. Moreover, it can also have rate sensor 2C so that the vehicle speed (V) with a rotational frequency (N) and correlation instead of rotational frequency sensor 2B may be detected. Rate sensor 2C detects the vehicle speed (V) of a car, and sends (vehicle speed V) signal 2c to the false sound selection means 3. In addition, although future explanation describes the case where rotational frequency sensor 2B is used, it is the same also about the

rate sensor C.

[0015] Accelerator opening sensor 2D detects the opening (X) of an accelerator, and sends 2d of accelerator opening (X) signals to the false sound selection means 3. It constitutes so that 2d of accelerator opening (X) signals may also output the electrical potential difference corresponding to the accelerator opening X, or a current value.

[0016] Thus, a sensor 2 detects the starting S of electric rolling stock, the rotational frequency N of a motor (or the vehicle speed V of a car), and the accelerator opening X, and outputs the electric signal (an electrical-potential-difference value, current value) corresponding to each amount of detection.

[0017] The false sound selection means 3 is equipped with the starting tone selection section 11, the transit tone selection section 12, and the loudness-level-of-sound selection section 13, and while controlling selection of the starting sound of the electric rolling stock generated with the false sound-source means 4, and a transit sound based on the various signals outputted from a sensor 2, it constitutes so that selection of a sound-volume change means 5 to change sound volume of a starting sound and a transit sound may be controlled.

[0018] The starting tone selection section 11 provides the false sound-source means 4 with 2 kinds of starting tone selection information 11a based on (Starting S) signal 2a from starting sensor 2A, and selects the tone beforehand set up as a starting sound. Starting tone selection information 11a sets up information according to the false sound source which used the configuration of the false sound-source means 4, for example, the transmitter of a simple oscillation frequency, the speech synthesis means, or the digital signal processor (DSP), and it constitutes the starting tone selection section 11 so that an electrical potential difference or ON / off information of a current, digital bit information, etc. may be generated. Moreover, the starting tone selection section 11 can also be constituted as a part of transit tone selection section 12.

[0019] The transit tone selection section 12 provides the false sound-source means 4 with transit tone selection information 12a corresponding to the

electrical potential difference of (rotational frequency N) signal 2b, or the level value of a current based on (rotational frequency N) signal 2b from rotational frequency sensor 2B. The transit tone selection section 12 is constituted so that an electrical potential difference corresponding to a gestalt, a current, or digital bit information on the false sound-source means 4 which consists of transmitters, speech synthesis means, or digital signal processors (DSP) of the simple oscillation frequency as starting tone selection information 11a outputted from the starting tone selection section 11 also with same for example, transit tone selection information 12a etc. may be generated.

[0020] Moreover, the transit tone selection section 12 is controlled to stop a starting sound, when delivery and electric rolling stock start delivery or loudness-level-of-sound selection stop signal 12c in the starting tone selection section 11 and start transit for tone selection stop signal 12b in the loudness-level-of-sound selection section 13.

[0021] The loudness-level-of-sound selection section 13 Starting (S) signal 2a from a sensor 2, (rotational frequency N) signal 2b, It is based on accelerator opening (X) signal 2c or noise detection information 10a from the noise detection means 10. While providing the sound-volume change means 5 with sound-volume change information 13a and controlling the sound-volume change of starting of electric rolling stock, a motor rotational frequency (vehicle speed), and the false sound corresponding to accelerator opening (acceleration/moderation), it constitutes so that the sound-volume change of the false sound corresponding to ambient noise may be controlled.

[0022] The false sound-source means 4 is a sound source for generating the false sound corresponding to starting [of electric rolling stock], transit (advance or go-ahead), acceleration / moderation condition. for example, a simple oscillator or two or more of its combination, and in order to issue change further, combine a modulator, or Adoption of the speech synthesis IC constituted so that the condition sound of starting of a gasoline automobile, transit, and acceleration/moderation might be recorded and outputted [compound and], or

the digital signal processor (DSP) which can calculate / process and can generate the wave of arbitration can constitute. The false sound-source means 4 provides the sound-volume change means 5 with a starting sound signal or the transit sound signals 4a and 4b based on starting tone selection information 11a from the starting tone selection section 11, or transit tone selection information 12a from the transit tone selection section 12.

[0023] Drawing 2 is the block block diagram showing one example of the false sound-source means of the false sound generator for electric rolling stock concerning this invention. (a) In drawing, the false sound-source means 20 is equipped with an oscillator 21 - an oscillator 23, an adder 24, and a multiplier (modulator) 25, and equips an oscillator 21 - an oscillator 23 with the resistance groups 21A-23A for an oscillation frequency change, respectively.

[0024] If electric rolling stock start and starting tone selection information 11a is offered from the starting tone selection section 11 of the false sound selection means 3, based on starting tone selection information 11a, predetermined resistance will be selected out of RA-RC of the resistance groups 21A-23A for an oscillation frequency change, respectively, it will oscillate on the oscillation frequencies f_{o1} , f_{o2} , and f_{o3} , and an oscillator 21 - an oscillator 23 will output the oscillation output signals 21a-23a.

[0025] Oscillation output signal 21a of an oscillator 21 and oscillation output signal 22a of an oscillator 22 are added with an adder 24, and supply addition signal of 2 cycle 24a to a multiplier 25. On the other hand, since oscillation output signal 23a from an oscillator 23 is supplied to a multiplier 25, addition signal 24a is modulated by oscillation output signal 23a, and this modulating signal is outputted to the sound-volume change means 5 as starting sound signals 4a or 4b.

[0026] (b) Drawing shows the signal wave form where it corresponded to the (a) Fig. The oscillator 21 - the oscillator 23 were constituted so that a sinusoidal form might be outputted, but by constituting or making the wave of addition output 24a of an adder 24 distorted so that a square wave may be outputted, it can also

constitute so that a fundamental wave and harmonic content may be generated. Moreover, although the modulation was constituted from AM (amplitude modulation) in the (b) Fig., a different tone can also be obtained by constituting from FM (frequency modulation) or PM (phase modulation).

[0027] In addition, although 2 sets of starting sound signals 4a and 4b correspond the configuration of drawing 2 in preparation for the case where the tone the inside of electric rolling stock and besides a car is made to differ, when both tone is common, they are good at either starting sound signal 4a or 4b.

[0028] Next, if electric rolling stock will be in a run state, based on transit tone selection information 12a from the transit tone selection section 12, predetermined resistance will be selected out of RA-RC of the resistance groups 21A-23A respectively for an oscillation frequency change in an oscillator 21 - an oscillator 23. It oscillates by the oscillation frequencies f1-fa corresponding to the level of transit tone selection information 12a, f2-fb, and f3-fc, and the oscillation output signals 21a-23a are outputted. Moreover, the oscillation frequencies f1-fa, f2-fb, and f3-fc are set up so that it may become high, as the travel speed (it corresponds to a motor rotational frequency) of electric rolling stock becomes quick. In addition, about an oscillation wave, addition, and multiplication (modulation), it becomes being the same as that of drawing 2 .

[0029] Drawing 3 is the block block diagram showing another example of the false sound-source means of the false sound generator for electric rolling stock concerning this invention. The false sound-source means 30 is equipped with a control section 32, the speech synthesis section 33, and the voice data section 34 in drawing 3 .

[0030] The voice data section 34 consists of memory, such as a mask ROM, for example, records beforehand the starting sound (engine sound) of a gasoline automobile, the travel speed, or the transit sound corresponding to acceleration/moderation, and after it processes analysis etc. in the recorded sound, it memorizes it as sound data.

[0031] A control section 32 is based on starting tone selection information 11a

from the starting tone selection section 11, or transit tone selection information 12a from the transit tone selection section 12. Supplying driving signal 32a to the speech synthesis section 33, the speech synthesis section 33 delivers information 34a in between with the voice data section 34 based on driving signal 32a, compounds the voice data memorized by the voice data section 34, and generates a starting sound signal and a transit sound signal.

[0032] Since the compound starting sound signal and a transit sound signal are generated based on the starting sound of a gasoline automobile, and a transit sound, they can obtain the sound near an actual gasoline automobile. Moreover, the control section 32, the speech synthesis section 33, and the voice data section 34 which constitute the false sound-source means 30 can be constituted from an IC, respectively, or they collect each ICs, and when there is little voice data, they can constitute [**** / constituting from a hybrid IC (HIC)] them from micro PUROSSESSA (CPU) of one chip.

[0033] Moreover, the false sound-source means 4 is constituted from a digital signal processor (DSP) which can generate the signal wave form of arbitration, and the starting sound and transit sound of a gasoline automobile can be reproduced, or it can also be constituted so that the false sound of the starting sound suitable for electric rolling stock and a transit sound may be generated.

[0034] The sound-volume change means 5 controls the starting sound signal or the transit sound signals 4a and 4b which were generated from the false sound-source means 4 to predetermined signal level based on sound-volume change information 13a from the loudness-level-of-sound selection section 13, and sends out the false sound signals 5a and 5b to the low frequency output amplifiers 6 and 8, respectively.

[0035] Drawing 4 is the block block diagram showing one example of the sound-volume change means of the false sound generator for electric rolling stock concerning this invention. (a) Drawing shows the example from which the resistance attenuator and the (b) Fig. constituted the sound-volume change means respectively using the differential amplifier.

[0036] (a) The sound-volume change means 40 of drawing is equipped with the attenuator 41 which consists of resistance r_1 - r_n , and the circuit changing switch 42 which consists of s_1 - s_n which change resistance. The magnitude of attenuation of an attenuator 41 is determined corresponding to the switch which chose and chose the predetermined switch of s_1 - s_n corresponding to sound-volume change information 13a from the loudness-level-of-sound selection section 13, and a circuit changing switch 42 decreases the starting sound signal or the transit sound signals 4a and 4b which were generated from the false sound-source means 4, and sends out the false sound signals 5a and 5b to the low frequency output amplifiers 6 and 8, respectively. In addition, a circuit changing switch 42 is constituted from an electronic switch, and s_1 - s_n are chosen, or it is constituted so that s_1 - s_n may be chosen corresponding to the digital binary value which is sound-volume change information 13a corresponding to the electrical potential difference / current level which is sound-volume change information 13a.

[0037] (b) The sound-volume change means 50 of drawing is equipped with the resistance group 51 which consists of R_1 - R_n , the circuit changing switch 52 which consists of s_1 - s_n , and the differential amplifier 53. The magnitude of attenuation (or the amount of magnification) of the sound-volume change means 50 can be determined by the ratio (R_f / R_1 - R_n) of a feedback resistor R_f and the resistance group 51 by constituting the input impedance of the differential amplifier 53 from a resistance group 51. For example, when 51 resistance group R_1 is chosen, level of the false sound signals 5a and 5b is decreased the twice (R_f/R_1) of the level of a starting sound signal or the transit sound signals 4a and 4b (or magnification). In addition, a circuit changing switch 52 is constituted like the circuit changing switch 42 of the (a) Fig.

[0038] Low-frequency amplifier 6 and 8 amplifies the false sound signals 5a and 5b offered from the sound-volume change means 5, respectively, inputs amplified false sound signal outside car 6a, and false sound signal in car 6b into the car external use loudspeaker 7 and the car internal use loudspeaker 9,

respectively, and generates the false sound for electric rolling stock.

[0039] Drawing 5 is the frequency of the false sound of the false sound generator for electric rolling stock concerning this invention, and the property Fig. of sound volume. (a) The relation of the false sound volume [as opposed to the motor rotational frequency N of electric rolling stock and the accelerator opening X in the property of the false sound frequency f of as opposed to the motor rotational frequency N of electric rolling stock in drawing, and the (b) Fig.] P , and the (c) Fig. show the relation of the false sound volume P to the vehicle speed V . (a) In drawing, when an engine speed is zero ($N=0$) that is, the motor of electric rolling stock does not rotate but it is shown that the false sound frequency f of a starting sound is f_0 ($f=f_0$) in the state of starting whose driver operated the car key.

[0040] Next, electric rolling stock start transit, the rotational frequency N of a motor follows on increasing, and it constitutes so that, as for the false sound frequency f , the false sound frequency f of a transit sound may maintain f_k ($f=f_k$), if it becomes high in proportion to a rotational frequency N and a rotational frequency N exceeds the predetermined value N_k .

[0041] (b) In drawing, in the state of starting, if it is P_0 (dBspl: sound pressure level) when it is zero ($N=0$), it will become large in proportion to the increment in a rotational frequency N if a rotational frequency N will be in a run state, and it surpasses the value N_a predetermined in a rotational frequency N , as for the false sound volume P of a starting sound, electric rolling stock constitute so that the false sound volume P of a transit sound may be saturated and may maintain sound volume P_a . Moreover, the false sound volume P is increased in proportion to the accelerator opening X , and the false sound volume P to the accelerator opening X constitutes the false sound volume P so that you may not make it saturated.

[0042] (c) Drawing shows the sound volume to the vehicle speed V of a gasoline car and electric rolling stock, and to a gasoline car increasing from sound volume P_M gently corresponding to the vehicle speed V , set up electric rolling stock so that it may be made to increase from the false sound volume P_0 gradually for

example, corresponding to the vehicle speed V and the difference with the sound volume of a gasoline car may be buried.

[0043] As mentioned above, it constituted from drawing 5 so that the false sound frequency f and the false sound volume P might be linearly increased in proportion to a rotational frequency N , and the accelerator opening X and the vehicle speed V , but it can set up so that it may become another curvilinear relation, and it can also constitute so that the transit sound of suitable electric rolling stock may be obtained.

[0044] Drawing 6 is the sound-volume property Fig. of the false sound of the false sound generator for electric rolling stock concerning this invention. In drawing 6, a three dimension shows the false sound pressure P of the motor rotational frequency N of electric rolling stock, and the transit sound to the accelerator opening X .

[0045] When a rotational frequency N and Opening X are zero (at the time of starting), electric rolling stock have false sound pressure in a starting condition by P_0 , and it can reproduce the false sound which was rich in change of the acceleration/moderation under transit with a rotational frequency N and the combination of the accelerator opening X to a run state.

[0046] The noise detection means 10 is constituted from a logarithmic amplifier (log amplifier) which amplifies the large (for example, 60 phons - 100 phons) noise of the level range detected with the microphone for ambient noise detection which is not illustrated, and the microphone in the predetermined range, a transducer which changes the output of a logarithmic amplifier into the direct current level of a current or an electrical potential difference, or a digital bit sign, and the loudness-level-of-sound selection section 13 is provided with noise detection information 10a which changed noise level into direct current level or a bit sign.

[0047] Since it fluctuates corresponding to noise level, through the loudness-level-of-sound selection section 13 and the sound-volume change means 5, noise detection information 10a is the sound volume corresponding to the

ambient noise from the car external use loudspeaker 7 and the car internal use loudspeaker 9, and generates the false sound of a starting sound and a transit sound. Moreover, control of the false sound volume by ambient noise is constituted so that it may carry out independently with control of transit false sound volume including the acceleration/moderation by the starting sound or accelerator actuation, and stride constitutes transit false sound volume including the acceleration/moderation by the starting sound or accelerator actuation so that it may shift in the small direction.

[0048] Transit false sound volume including the acceleration/moderation by the starting sound or accelerator actuation shown in drawing 6 shifts the sound-volume property of the false sound of the electric rolling stock by ambient noise in the up-and-down (sound-volume size) direction of an arrow head, and when the noise is loud, when a direction and the noise are small, it shifts to a direction the bottom (sound-volume reduction) a top (increment in sound volume).

[0049] In addition, arrangement of the car external-use loudspeaker 7 to electric rolling stock, the car internal-use loudspeaker 9, and the microphone for noise detection installs the car external-use loudspeaker 7 in the location distant from the car external-use loudspeaker 7 so that the pars basilaris ossis occipitalis of a car body or the effect of a false sound under which it installs so that two pieces may be prepared, it may arrange before and after a car body and almost equal sound volume may be obtained around a car body, and the microphone for noise detection is generated from the car external-use loudspeaker 7 may decrease as much as possible. A driver does not sense troublesomeness and installs the car internal use loudspeaker 9 in consideration of the location which can be caught.

[0050] Drawing 7 is the whole another example block block diagram of the false sound generator for electric rolling stock concerning this invention. In drawing 7, the point equipped with the sound-volume circuit changing switch 64 with which a driver changes a false sound-source means 61 by which the false sound generator 60 for electric rolling stock consists of two or more **** (1-n), the sound-source circuit changing switch 63, with which a driver changes the sound

source 1 - sound source n of this false sound-source means 61 by manual operation, the sound-volume change means 62 containing the sound-volume switcher for a manual change, and this sound-volume change means 62 by manual operation differs from drawing 1 .

[0051] When it has the sound source 1 which generates a false sound which is different from drawing 1 having explained with the same configuration - a sound source n and a driver operates the sound-source circuit changing switch 63 manually, the false sound-source means 61 chooses the sound source (1-n) corresponding to switch information 63a, generates a false sound, and provides the sound-volume change means 62 with a starting sound signal or the transit sound signals 61a and 61b. Moreover, each sound source of the sound source 1 of the false sound-source means 61 - a sound source n is controlled like the false sound source 4 of drawing 1 based on starting tone selection information 11a from the starting tone selection section 11 of the false sound selection means 3, or transit tone selection information 12a from the transit tone selection section 12.

[0052] When a resistance group is connected to a serial, juxtaposition, or a serial parallel and a driver operates the sound-volume circuit changing switch 64 manually in the attenuator 41 or the resistance group 51 for a sound-volume change shown in (a) of drawing 4 , and (b), the sound-volume change means 62 selects the resistance group corresponding to switch signal 64a, adjusts sound volume, and sends out the false sound signals 62a and 62b to the low frequency output amplifiers 6 and 8, respectively.

[0053] Thus, since the false sound-source means 61 and the sound-volume change means 62 of a manual change were established, a driver can operate the sound-source circuit changing switch 63 and the sound-volume circuit changing switch 64 manually, and the false sound generator 60 for electric rolling stock can generate the tone quality and the false sound of sound volume according to liking.

[0054]

[Effect of the Invention] The false sound generator for electric rolling stock

applied to this invention as explained above can generate the false sound suitable for the condition of electric rolling stock, such as acceleration/moderation under starting of electric rolling stock, transit, and transit.

[0055] Moreover, according to ambient noise, false sound volume, such as acceleration/moderation under starting of electric rolling stock, transit, and transit, can be changed.

[0056] Therefore, a pedestrian and a driver can recognize the run state of starting of electric rolling stock, and acceleration/moderation, and to a gasoline automobile, if, they can carry out same correspondence.

[0057] Moreover, since a false sound can be automatically adjusted corresponding to ambient noise, low noise-ization in night or a quiet location is realizable.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The whole false sound generator block block diagram for electric rolling stock concerning this invention

[Drawing 2] The block block diagram showing one example of the false sound-

source means of the false sound generator for electric rolling stock concerning this invention

[Drawing 3] The block block diagram showing another example of the false sound-source means of the false sound generator for electric rolling stock concerning this invention

[Drawing 4] The block block diagram showing one example of the sound-volume change means of the false sound generator for electric rolling stock concerning this invention

[Drawing 5] The frequency of the false sound of the false sound generator for electric rolling stock concerning this invention, the property Fig. of sound volume

[Drawing 6] The sound-volume property Fig. of the false sound of the false sound generator for electric rolling stock concerning this invention

[Drawing 7] The whole another example block block diagram of the false sound generator for electric rolling stock concerning this invention

[Description of Notations]

1 60 -- The false sound generator for electric rolling stock, 2 -- A sensor, 2A -- Starting sensor, 2B -- A rotational frequency sensor, 2C -- A rate sensor, 2D -- Accelerator opening sensor, 3 -- A false sound selection means, 4, 20, 30, 61 -- A false sound-source means, 5, 40, 50, 62 -- Sound-volume change means, 6 8 [-- Starting tone selection section,] -- 7 Amplifier, 9 -- A loudspeaker, 10 -- A noise detection means, 11 12 -- The transit tone selection section, 13 -- The loudness-level-of-sound selection section, 21-23 -- Oscillator, 21A-23A -- The resistance group for an oscillation frequency change, 24 -- An adder, 25 -- Multiplier (modulator), 31 [-- The voice data section, 41 / -- 42 An attenuator, 52 / -- A circuit changing switch, 51 / -- A resistance group, 53 / -- The differential amplifier, 63 / -- A sound-source circuit changing switch, 64 / -- Sound-volume circuit changing switch.] -- Speech synthesis IC, 32 -- A control section, 33 -- The speech synthesis section, 34

[Translation done.]

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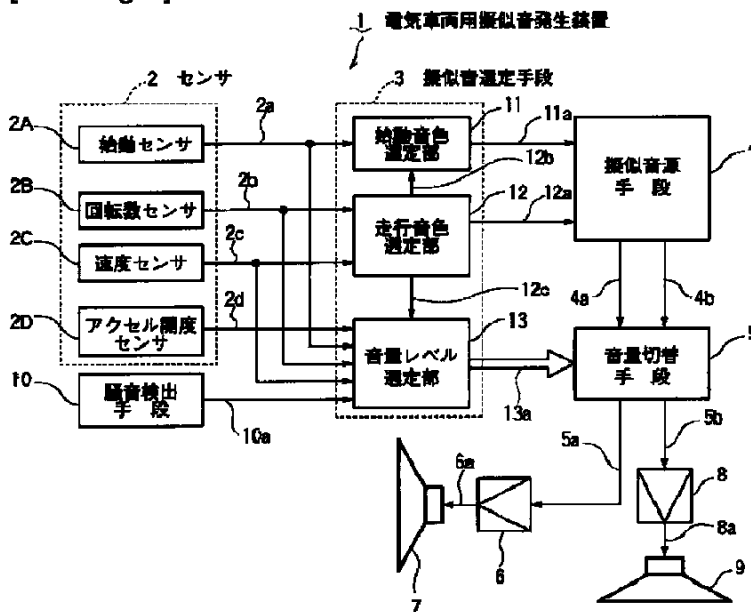
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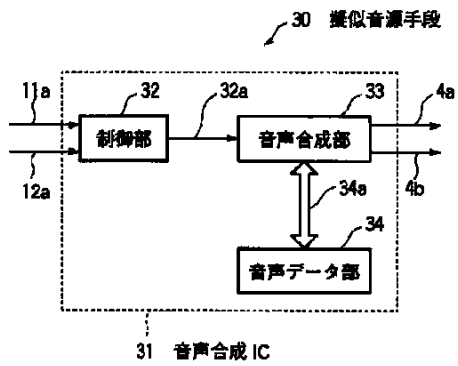
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DRAWINGS

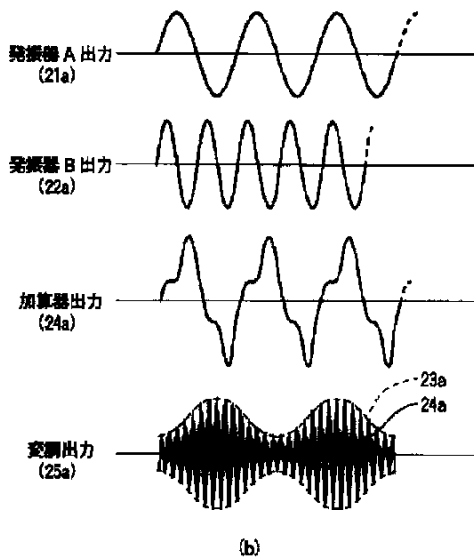
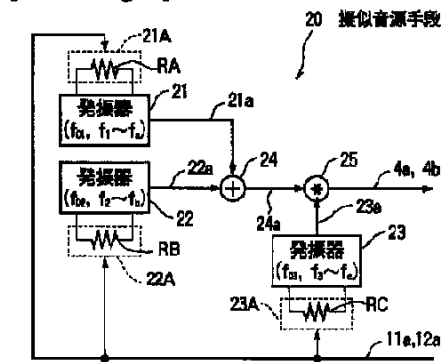
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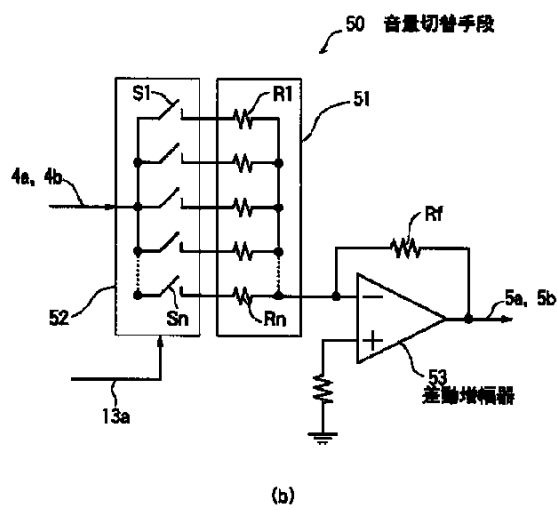
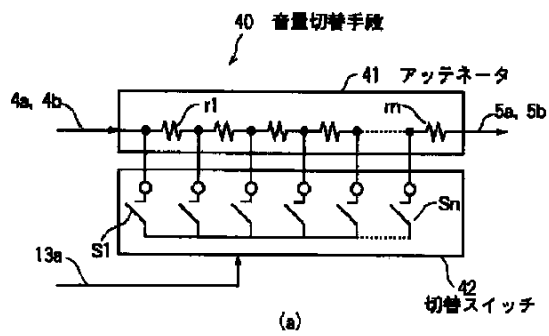
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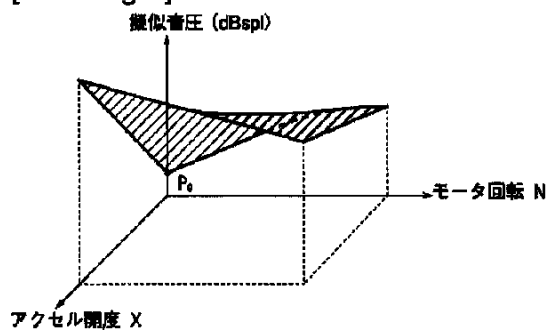
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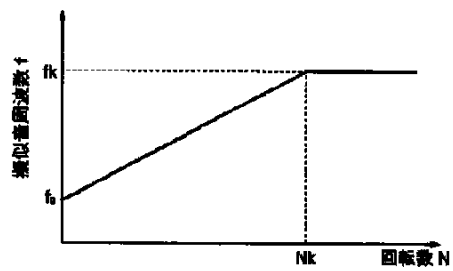
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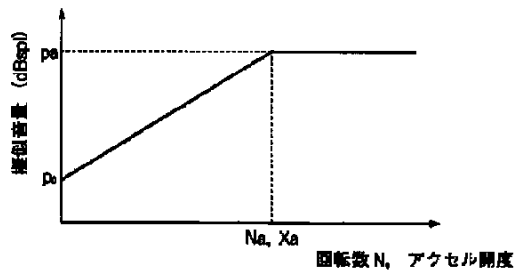
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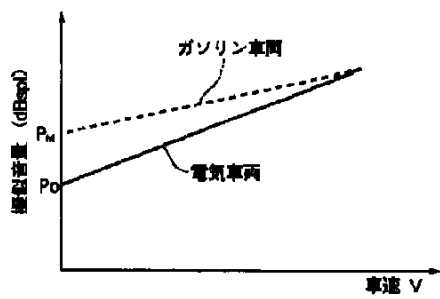
[Drawing 5]



(a)

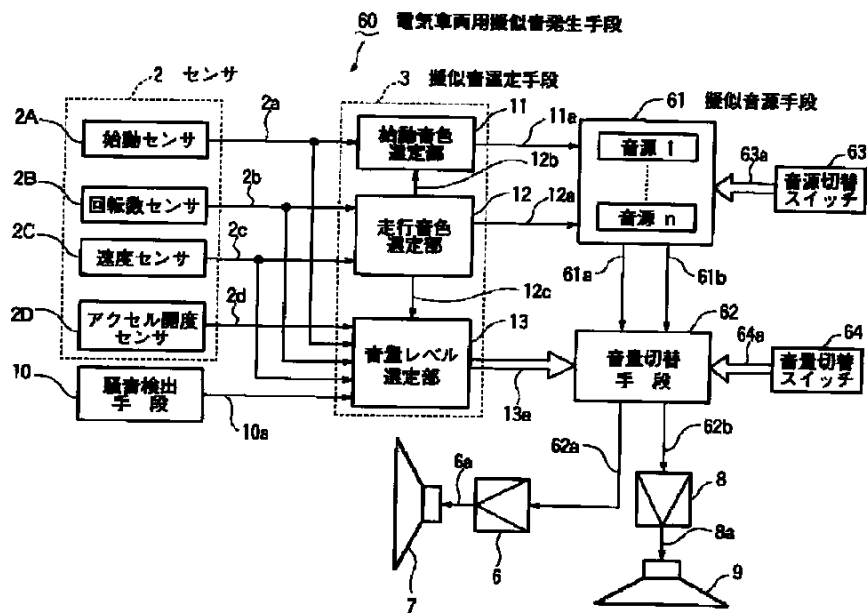


(b)



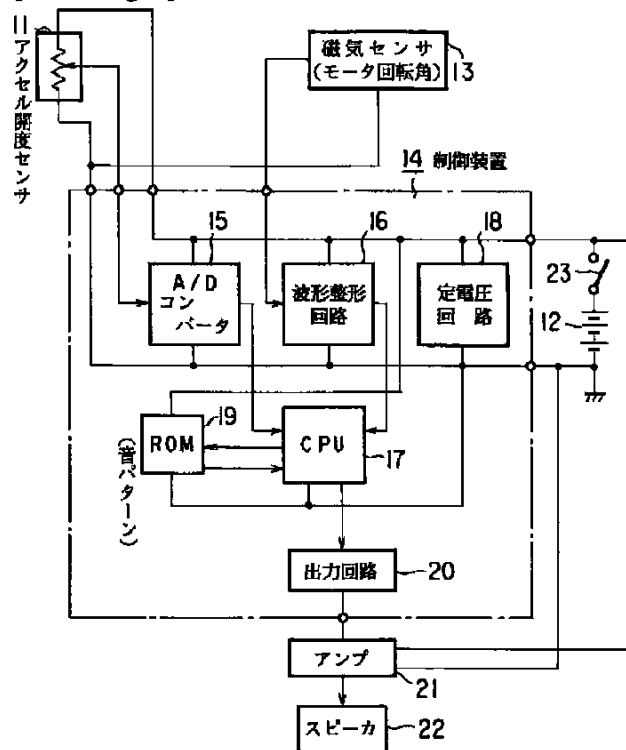
(c)

[Drawing 7]



[Translation done.]

[Drawing 1]



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